

Observations on the Structure of Amœba and Actinophrys.

At a recent meeting of the Boston (U.S.) Society of Natural History, Dr. J. Wyman gave an account of some observations which he had recently made on an *Amœba*.

The species referred to appeared in some fibrine which had been confined between two plates of glass for the purpose of watching the progress of its decomposition in water. The *Amœbæ* were first noticed as minute points, and gradually grew to full size, without any obvious change of form or structure. As seen under the microscope, they appeared to be made up of a spherical sarcodic mass, which was structureless, and in which were imbedded numerous granules, from which last, however, a portion of the circumference of the organism was wholly free. Solid bodies, lodged in the interior, were seen to be discharged at various points in the circumference, seeming to meet with little or no obstruction; and yet no *opening* was discovered at any point. When the body to be discharged came near the surface, the sarcode was pushed out before it, becoming more and more prominent outwards, and at length broke like a bubble, leaving the contained body free.

The *Amœba*, in one instance, underwent complete spontaneous division in five minutes; first taking on the shape of a dumb-bell, then the two principal masses receded from each other, the band which united them became thinner, and finally broke, just as does the thread which connects two viscid bodies when drawn apart, and two complete *Amœbæ* were formed. In another instance, the division had become nearly complete, as just described; but the two masses, instead of separating wholly, again approached each other, and nearly recovered their original shape.

From the manner in which solid particles pass through these structures, and the rapidity with which the whole organism becomes subdivided, it is reasonable to infer that they have no proper integument, especially as the microscope fails to reveal such a structure.

Prof. Henry James Clark said that *Actinophrys* was particularly interesting, as manifesting a step higher than the simple homomorphous organization of *Amœba* as described by Prof. Wyman. Prof. Clark referred to Kölliker's observations in 1849, as recorded in the 'Zeitschrift für wissenschaftliche Zoologie,' and showed that, even supposing Kölliker to be correct, the division of the mass of the body into an exterior and interior portion, the former containing much larger vacuoles than the latter, indicated a heteromorphous organization, tending towards specialization of parts. He also added that he could not agree with Kölliker that *Actinophrys* is a homomorphous mass with vacuoles, but that he was convinced that the so-called vacuoles of the outer and inner layers are true cells, with a distinct wall about them, a wall that could be easily recognized with the help of the better sort of microscope-objectives of the present day. Owing to the exceeding transparency of the organism, no ordinary objective will show the walls; but with a one-quarter-inch lens, of one hundred and fifty degrees angular aperture, made for him, last June, by Tolles, of Canastota, N. Y., he had no difficulty in working, with

the proper adjustment and corrections, through a sufficient depth of water to completely cover the *Actinophrys* (*A. Eichhornii*), and could readily detect the walls, not only of the superficial cells, but also of the innermost ones*.

What is remarkable, too, the pseudopodia, as frequent and careful observations have led him to determine, invariably alternate with the cells of the exterior layer; that is, they are prolongations of the intercellular amorphous substance of the body. This fact would seem to add to the proof that the so-called vacuoles are really cells; otherwise it would be hardly credible that simple vacuoles, which come and go in an amorphous substance, should always alternate with the pseudopodia.

Sometimes a pseudopod moves very rapidly, especially when it has seized upon some victim; for then it retracts with a sudden jerk, and draws the prey close to the body, which finally engulfs it in the same manner as does *Amœba*. The pseudopodia exhibit an adhesive power which is remarkable when we consider the size of the animals which are sometimes drawn in by them, and in this respect remind one of the "adhesive vesicles" in the anchors of *Lucernariæ*, which hold fast to bodies with the greatest tenacity, and, to all appearances, by simple contact, just as glue and mucus adhere to anything which touches them. [See Prof. Clark's paper "on *Lucernaria*, the Cœnotype of *Acalephæ*," Proc. Bost. Soc. Nat. Hist. vol. ix. (1862) p. 52, and also reprinted, "with additions and notes," in the 'Annals of Natural History,' July 1863, p. 19.] In a *Diffugia* (very near *D. proteiformis*), Prof. Clark had observed that whenever the pseudopodia contract, they invariably become strongly wrinkled transversely; and, as he could not detect the least trace of an envelope or wall-like layer on this part of the body, he believed that the wrinkling is peculiar to the substance of the pseudopodia.

[In connexion with this, I will take the opportunity to assert that,

* [The unprecedented working distance which accompanies the great angle of aperture in the above-mentioned lens prompts me to speak more fully of its excellence. It has been the chief desideratum of naturalists to obtain a large increase in the working distance of those lenses which have a great angle of aperture; but hitherto the latter condition has seemed to involve necessarily an excessively short working distance, and consequently great inconvenience in the investigation of all bodies which are not correspondingly thin. The idea of studying marine animals in their native element with such lenses could never be indulged in, for fear of ruining the objectives by contact with salt water. At last we are relieved from this restraint; for within the last four or five years a great improvement has been made in this respect by opticians, at least by Mr. Tolles. The most recently constructed lens which I have received from that gentleman was made last June; it is a one-quarter-inch objective, with an angular aperture of *one hundred and fifty degrees*, and a most unexpected working distance of *one-fiftieth of an inch* for uncovered bodies. By experiment, I also find that it works through a glass covering fully *one-fortieth of an inch thick*, and with some room to spare above that. The working distance through water I have not measured accurately; but that can be inferred from the difference between its refraction and that of glass. The defining power of this lens is certainly unsurpassed, if not unequalled.—H. J. C.]

from a number of observations on various animals, I have been led to the conclusion that *all vibratile cilia originate in the amorphous intercellular substance*. In no instance have I ever seen vibratile cilia forming direct prolongations of cells, but invariably I find their bases imbedded in the intercellular cytoblastema. They may seem to be prolonged from the underlying cells; but, on the contrary, as I have particularly satisfied myself in regard to the branchiæ of the oyster (*Ostrea virginiana*), they are based in the cytoblastema, which extends in a thin stratum over the outer ends of the cells. In other instances they alternate with the cells, projecting in rows between them, and forming, as it were, a bristling corona to each cell, as I have seen in the epithelium of the intestine of the young Snapping Turtle (*Chelydra serpentina*). In the latter instance, when the cells are loosed from the intestine, they carry the overlying cytoblastema with them, and consequently, also, the vibratile cilia, which then falsely appear like appendages of the cells themselves. The nettling cells (*cnidæ*) of Polypi and Acalephæ originate in the same substance (the intercellular cytoblastema) as do vibratile cilia. They have been supposed to *develop within the cells* of the layer in which they are situated; *but this is not true*. Oftentimes, when *cnidæ* are removed from their basis by pressure, they drag along with them a portion of the cytoblastema, which encloses them like a transparent envelope, and has the appearance of a cell. Sometimes three or four *cnidæ* are pressed out together, and, being covered by the accompanying cytoblastema, they present the deceptive appearance of several *cnidæ* in one cell.

There are four periods in the history of *cnidæ*. Wagner (Wieg. Archiv, 1835) was the first to detect the existence of these bodies; but he mistook them for peculiar forms of spermatozoa of *Actinia Cereus*. Immediately after this, if not at the same date, Ehrenberg (Abhandl. Berlin Akad. 1835, Jahrg. [1837] p. 147) recognized their true office, and described them as the prehensile organs (Fangangeln) of Hydra. Yet in 1842 (Wieg. Archiv) we find him inclined to deny that they have *stinging* properties, such as Wagner attributes to those which he found in *Pelagia noctiluca*. In 1841 (Wieg. Archiv, p. 38) Wagner described the nettling-organs (Nesselorgane) of *Pelagia noctiluca*; and although he detected the spirally-rolled thread in the capsule, and says of the thread, "sometimes it appears as if it had a canal," and figures it so in his 'Icones Zootomicæ' (1841, pl. 33. fig. 9 B), yet it was reserved for Doyère, in the latter part of the next year (Comptes Rendus, Aug. 1842, p. 429, "Note sur quelques points de l'Anatomie des Hydres d'Eau douce"), to describe the mechanism of the *cnidæ*, and the mode of evolution of the thread, with such completeness as to anticipate everything in this regard that has been published since, up to the year 1860, when I figured and briefly pointed out (in Agassiz's 'Contributions,' vol. iii. pl. 11^b. fig. 16^a, *Aurelia flavidula*, and description of plate, p. 17, and pl. 11^c. fig. 5, *Coryne mirabilis*) an as yet undescribed relation of the thread to the cell in which it is coiled up. As the brilliant discovery of Doyère has been kept in comparative obscurity, at least in America, I will quote from his paper such

passages as will make it clear that he deserves the credit which has been assumed by those who have merely *repeated his observations*. On page 430, 'Comptes Rendus,' he says, "Ainsi le *spicule* ou *dard*, figuré dans l'intérieur du sac par M. Corda (*calcareo sagitta*, Corda), et représenté saillant au dehors par M. Ehrenberg, dans sa planche 2. fig. 7 b, n'est autre que l'espèce de calice basilaire à trois points en étoile, des prétendus hameçons. Le long filament grêle qui part de ce calice étoilé était, avant l'évolution, invaginé en dedans de lui-même et du calice ou spicule par un *retournement en doigt de gant*, et formait au fond du sac cette apparence de coussin que M. Corda a nommé *vesica patelliformis*; un examen attentif et d'excellents instruments font même reconnaître dans ce coussin sa composition par un fil enroulé en spirale." On page 431 he speaks of the evolution of the thread of this and another smaller nettling-cell by *ensheathing itself*: "des corpuscules plus petits et surtout beaucoup plus étroits que les précédents, ovoïdes, à parois épaisses contenant à leur intérieur un fil enroulé en spirale, qui sort comme le long filament des hameçons, en s'engageant en dedans de lui-même." All that I have been able to add to this, although the subject has been pursued with the utmost rigour, and with the best lenses to be had, is the description of the relation of the coiled thread to that part of its base which projects straight into the cavity of the cell. Perhaps the greatest importance that can be attached to this is that it is the most difficult to make out. However, the discovery of this feature solves the whole mechanism of the organ. Although I had, in 1860, figured and briefly indicated (Agassiz's 'Contributions' *ut supra*) this part of its structure, yet it was not until the fourth volume of the 'Contributions' appeared, in 1862, that I described it, in full, as I had seen it in various animals, viz. in the ephyra of *Aurelia flavidula* (p. 44), the Hydra form of *Coryne mirabilis* (p. 209), *Actinia marginata* (p. 210), and *Hydractinia polyclina* (p. 237). At first sight, I might seem to be anticipated in this by Gosse, in his 'Evenings with the Microscope,' London, 1859, or in his 'Actinologia Britannica,' London, 1860, p. xxix, Introduction, and pl. 11. fig. 6; but, upon examination of the illustration, I find nothing to justify it; and, from the description in connexion with the figure, I should judge that the cnidæ had been injured and distorted by pressure. However, I leave it to others to decide whether Gosse's description is sufficient to clear up the subject on this point.

Among the Ctenophoræ the cnidæ are so numerous and so closely packed together, as to form a uniform layer all over the surface of the tentacle totally outside of the exterior wall.—H. J. C.]

On the Writings of C. S. RAFINESQUE.

To the Editors of the *Annals and Magazine of Natural History*.

GENTLEMEN,—Will you allow me to state, for the information of your readers, that a long-desired work is about to be accomplished in Philadelphia, namely, the reproduction of the complete writings of Constantine Smlatz Rafinesque on Recent and Fossil Conchology, to be edited by W. G. Binney and G. W. Tryon, Jun. This indus-